

Applied Aerodynamics

Papers Presented at the AIAA SciTech Forum and Exposition
2023

National Harbor, Maryland, USA and Online
23-27 January 2023

Volume 1 of 7

ISBN: 978-1-7138-7561-1

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

The contents of this work are copyrighted and additional reproduction in whole or in part are expressly prohibited without the prior written permission of the Publisher or copyright holder. The resale of the entire proceeding as received from CURRAN is permitted.

For reprint permission, please contact AIAA's Business Manager, Technical Papers. Contact by phone at 703-264-7500; fax at 703-264-7551 or by mail at 34922 Uwytkug'Xcmg{'Ftkxg.'Uwky'422, Reston, VA 20191, USA.

TABLE OF CONTENTS

VOLUME 1

SPECIAL SESSION: HPC MULTI-PHYSICS CREATE I

| | |
|--|----|
| Development of GPGPU Capable Multi-Solver Overset Methods | 1 |
| <i>Jay Sitaraman, Dylan Jude</i> | |
| Advancements in HPCMP CREATE-AV™ ADAPT as an MDAO Front-End | 16 |
| <i>Andrew J. Field, Madeline Lickenbrock, Joseph Maclean, William McGough, Paul Syfrett, William Zuber</i> | |
| Responding Body Motion Simulation with Collision in the Kestrel Framework | 42 |
| <i>Andrew G. Denny, Robert P. McNally</i> | |

SPECIAL SESSION: AERODYNAMICS OF ROAD VEHICLES

| | |
|---|-----|
| Airbrake CFD Analysis for Land Speed Record Vehicles | 61 |
| <i>Antoine Gilles, Ioan I. Feier</i> | |
| Multi-Track, Multi-Rider Human Powered Land Speed Vehicle Aerodynamic CFD Analysis..... | 78 |
| <i>Julius Roger, Ioan I. Feier</i> | |
| Wheel Rotation Modeling Effects on the Flowfield Around DrivAer Notchback Model Variants | 88 |
| <i>Matthew T. Aultman, Lian Duan</i> | |
| Evaluation of CFD Methodologies for Predicting Wind Noise Sources Over the Front Side Window of a Sport Utility Vehicle | 104 |
| <i>Hang Li, Lian Duan, Rodrigo Auza-Gutierrez, Austin Kimbrell</i> | |

UNSTEADY AERODYNAMICS I

| | |
|---|-----|
| A Computational and Experimental Analysis of Vortex Shedding from Complex Turning Vanes | 125 |
| <i>Andrew P. Hayden, Cole Hefner, John Gillespie, Alexandrina Untaroiu, Todd Lowe</i> | |
| Experimental Generation and Characterization of Isolated Vortical Gusts..... | 160 |
| <i>Paras Vadher, Holger Babinsky</i> | |
| Interaction of a Small Unmanned Aerial System with a Moving Vehicle | 174 |
| <i>David Lee, Keith W. Moored, John T. Hrynuik</i> | |

FLOW CONTROL APPLICATIONS INCLUDING EXPERIMENT AND COMPUTATION I

| | |
|--|-----|
| Application of Active Flow Control Technologies for Improving the Stability Pitch Break Characteristics of a Generic Delta-Wing Configuration..... | 187 |
| <i>John R. Hooker, Andrew Wick, Cale H. Zeune, Aaron Altman, Gary D. Dale</i> | |
| Feasibility of a Spinning Cylinder on the Leading and Trailing Edges of a Flap for High Lift | 211 |
| <i>Antoine Francannet, Simon Prince, Davide Di Pasquale, Anderson Proenca</i> | |

| | |
|---|-----|
| Computational Study of Passive Flow Control for a MAV-Scale Eppler E423 Airfoil | 231 |
| <i>Salman K. Rahmani, Zhi J. Wang</i> | |

MISSILE/PROJECTILE/MUNITION AERODYNAMICS, CARRIAGE, AND STORE SEPARATION

| | |
|--|-----|
| Experimental and Numerical Comparison of Different Missile Body Cross Sectional Shapes..... | 249 |
| <i>Nathan Shumway, Mehdi Ghoreyshi</i> | |
| Dynamic Pressure Measurements in a Rectangular Cavity with Multiple Stores..... | 260 |
| <i>Eric D. Smith, Rajan Kumar, Timothy A. Eymann</i> | |
| Very-Large Eddy Simulations of Transonic Flows Within a Jet-Fighter Weapon Bay with Internal Store | 277 |
| <i>Ignacio Gonzalez-Martino, Netanel Viner, Hadar Ben-Gida</i> | |

SPECIAL SESSION: SUPERSONIC CONFIGURATIONS AT LOW SPEEDS (SCALOS) I

| | |
|---|-----|
| Supersonic Configurations at Low Speeds (SCALOS): Configuration Comparison of SCALOS to Existing Designs..... | 299 |
| <i>Eli Livne, Chester P. Nelson, Kuang-Ying Ting, Josh Ignacio, Nicolas Mavriplis, Reza M. Soltani</i> | |
| Supersonic Configurations at Low Speeds (SCALOS): The Aerodynamic Effects of Control Surfaces | 328 |
| <i>Eli Livne, Chester P. Nelson, Kuang-Ying Ting, Josh Ignacio, Nicolas Mavriplis, Reza M. Soltani</i> | |
| Supersonic Configurations at Low Speeds (SCALOS) Longitudinal Aerodynamics: Configuration Variations and Control Surfaces Effects | 369 |
| <i>Eli Livne, Chester P. Nelson, Kuang-Ying Ting, Josh Ignacio, Nicolas Mavriplis, Reza M. Soltani</i> | |
| Supersonic Configurations at Low Speeds (SCALOS): CFD Aided Wind Tunnel Data Corrections | 405 |
| <i>Eli Livne, Chester P. Nelson, Kuang-Ying Ting, Josh Ignacio, Nicolas Mavriplis, Reza M. Soltani</i> | |

SPECIAL SESSION: HPC MULTI-PHYSICS CREATE II

| | |
|---|-----|
| Machine Learning-Based Surrogate Modeling for Aerodynamic Loads Predictions | 432 |
| <i>Jennifer Abras, Todd Tuckey, David R. McDaniel, Nathan S. Hariharan</i> | |
| A Data-Driven Modeling Approach for Rotorcraft Store Separation | 448 |
| <i>Nicholas Peters, John A. Ekaterinaris, Andrew M. Wissink</i> | |
| Data-Driven Modeling of Aerodynamic Loadings for Tiltrotor Pylon Using Multi-Fidelity CFD Data | 472 |
| <i>Phuriwat Anusonti-Inthra</i> | |
| A Computational Environment for Aircraft Design and Acquisition Engineering | 488 |
| <i>Robert B. Haehnel, Deanna L. Hardin, Jordan T. Bates, Scott D. Christensen, Thomas L. Arnold, Marvin S. Brown, Andrew C. Bauer, Quyen T. Brannon, Joshua Q. Church, Amanda R. Catlett, Theresa R. Coumbe, Dallan C. Schofield, Beatrice F. Roget</i> | |

SPECIAL SESSION: SLS AERODYNAMICS I

| | |
|--|-----|
| An Overview of NASA Langley Low-Speed CFD Contributions to the Space Launch System Program | 500 |
| <i>Brent W. Pomeroy, Steven E. Krist, T. J. Wignall, Karen A. Deere, Michael W. Lee, Farhad Ghaffari, Jesse G. Collins, Nalin A. Ratnayake, Craig L. Streett, Oleg Goushcha, Patrick R. Shea, Jeremy Pinier, Amber Favaregh, Ethan Vogel</i> | |
| Launch Vehicle Ascent CFD for the Space Launch System | 543 |
| <i>Derek J. Dalle, Stuart E. Rogers, Jamie Meeroff, Aaron C. Burkhead, Daniel G. Schauerhamer, Joshua F. Diaz</i> | |
| Advances in Space Launch System Booster Separation CFD | 568 |
| <i>Jamie Meeroff, Derek J. Dalle, Stuart E. Rogers, Aaron C. Burkhead, Daniel G. Schauerhamer, Joshua F. Diaz</i> | |
| A Computational Study of Plume Modeling for Space Launch System Abort Scenarios | 591 |
| <i>Jonathan Boustani, Michael Applebaum, William Eppard, Thomas Steva, Leslie H. Hall</i> | |
| Ground Wind Loads on the Space Launch System Mobile Launcher Crew Access Arm | 620 |
| <i>Thomas J. Wignall, Jesse G. Collins, Brent W. Pomeroy, Jeremy Pinier</i> | |

TRANSONIC AND SUPERSONIC AERODYNAMICS I

| | |
|--|-----|
| Aerodynamic Effects of Surface Protuberance Sizes on Slender-Bodied Supersonic Vehicle | 631 |
| <i>Kazuki Nimura, Fumiya Tsutsui, Keiichi Ktamura, Satoshi Nonaka</i> | |
| Unsteadiness in Curved Shock-Induced Separation Due to Protuberances | 654 |
| <i>Ramachandra K, Sourabh Bhardwaj, Sriram Rengarajan</i> | |
| Low Speed Characteristics Study of Various Supersonic Airfoils Using Co-Flow Jet Active Flow Control | 667 |
| <i>Zhijin Lei, Gecheng Zha</i> | |
| Analysis of the Flow Development Towards Shock Buffet on an OAT15A Profile | 688 |
| <i>Alessandro Accorinti, Tim Korthäuer, Sven Scharnowski, Christian Kähler</i> | |

UNSTEADY AERODYNAMICS II

| | |
|--|-----|
| Numerical 6DOF Simulation of a Perching Wing Deforming UAV | 701 |
| <i>Wee Beng Tay, Woei-Leong Chan</i> | |

VOLUME 2

| | |
|--|-----|
| Embedded WMLES of Transonic Buffet on a Nacelle-Aircraft Configuration | 712 |
| <i>Marius Herr, Sebastian Spinner, Axel Probst, Rolf Radespiel, Ralf Rudnik</i> | |
| Spectral Model of Wall-Pressure Fluctuations Applied to the Transonic Flow Around a Generic Space Launcher | 728 |
| <i>Simon Lecler, Pierre-Elie Weiss, Sébastien Deck</i> | |

FLOW CONTROL APPLICATIONS INCLUDING EXPERIMENT AND COMPUTATION II

| | |
|--|-----|
| Experimental Investigation of Pressure Fluctuations Around Protuberances of Varying Shapes | 750 |
| <i>Nishanth Menakath, Gareth A. Vio, Nicholas J. Lawson, Nicholas F. Giannelis</i> | |
| Validation of CFD Analysis of Steady Blowing for Control of the Unstable Pitch Break on a FlyingWing..... | 766 |
| <i>John Parks, Michael Amitay, Rick Hooker, Andrew Wick</i> | |
| Optimization of Synthetic Jet to Enhance the Aerodynamic Performance of a VTOL Aircraft at Real Flight Conditions..... | 788 |
| <i>Hung D. Truong, Abderahmane Marouf, Yannick Hoarau, Jan B. Vos, Alain Gehri</i> | |

SPECIAL SESSION: SUPERSONIC CONFIGURATIONS AT LOW SPEEDS (SCALOS) II

| | |
|---|-----|
| Unsteady Vortex Lattice Linearization and Sensitivity Analyses for Control Models in Supersonic Aircraft Design | 802 |
| <i>Thiago A. Guimarães, Carlos E. Cesnik, Ilya Kolmanovsky</i> | |
| Flexibility Assessment of the Aeroelastic-Flight-Dynamic Behavior for Supersonic Aircraft..... | 812 |
| <i>Thiago A. Guimarães, Carlos E. Cesnik, Ilya Kolmanovsky</i> | |

SPECIAL SESSION: HPC MULTI-PHYSICS CREATE III

| | |
|--|-----|
| Application of CREATE™-AV Helios to XV-15 Tiltrotor | 827 |
| <i>Andrew M. Wissink, Dylan Jude, Jay Sitaraman, Steven Tran</i> | |
| High-Fidelity Simulations of Flight Dynamics and Trajectory of a Parachute-Payload System Leaving the C-17 Aircraft..... | 843 |
| <i>Mehdi Ghoreyshi, Keith Bergeron, Adam Jirasek, Jurgen Seidel, Gregory Noetscher</i> | |
| Demonstration of an Integrated Multiphase Capability Within Kestrel | 865 |
| <i>Stefen A. Lindörfer, Chris L. Robinson, Greg D. Power</i> | |
| CFD Study of a Counter-Rotating Propeller eVTOL Concept | 892 |
| <i>James Lewis, Andrew J. Lofthouse, Ashish Bagai</i> | |
| Enabling HH-60G Predictive Maintenance Via Computational Fluid Dynamics (CFD) Artificial Intelligence (AI) Rotorcraft Development and Modeling (CARD-M)..... | 906 |
| <i>Jesus Arias, Maia Gatlin, Alex Forbes, David A. Alvord</i> | |

SPECIAL SESSION: SLS AERODYNAMICS II

| | |
|---|-----|
| Experimental Characterization of the Space Launch System Block 1B Liftoff and Transition Environment | 923 |
| <i>Lee Mears, Patrick R. Shea, Jesse G. Collins, Sarah Langston, Morgan A. Walker, Jeremy Pinier</i> | |
| Improved Techniques for Measuring Static Ground Wind Loads on the NASA Space Launch System Mobile Launcher 2..... | 943 |
| <i>Jesse G. Collins, Lee Mears, Patrick R. Shea, Sarah Langston, Morgan A. Walker, Jeremy Pinier</i> | |

| | |
|---|-----|
| Overview of the High Reynolds Number Ascent Wind Tunnel Test of the Space Launch System at the National Transonic Facility..... | 961 |
| <i>David T. Chan, Patrick R. Shea, Scott Goodliff, Morgan A. Walker, Jesse G. Collins, Sarah Langston, Lee Mears, Elizabeth Rieken, Jeremy Pinier</i> | |

| | |
|---|-----|
| Force and Moment Analysis for the High Reynolds Number Wind Tunnel Test of the Space Launch System at Ascent Conditions | 991 |
| <i>Patrick R. Shea, David T. Chan, Morgan A. Walker, Sarah Langston, Jesse G. Collins, Lee Mears, Elizabeth Rieken, Jeremy Pinier</i> | |

| | |
|---|------|
| Parametric Study of the Forward Attachment Geometry for the Space Launch System Next Generation Booster..... | 1005 |
| <i>James M. Ramey, Ian M. Giles, Oleg Goushcha, Patrick S. Heaney, David J. Piatak, Martin K. Sekula, Francesco Soranna</i> | |

TRANSONIC AND SUPERSONIC AERODYNAMICS II

| | |
|---|------|
| Comparison of URANS and Hybrid RANS/LES Buffet Response of the Benchmark Supercritical Wing | 1029 |
| <i>Nicholas F. Giannelis, Gareth A. Vio</i> | |

| | |
|---|------|
| Wall-Modeled LES of Transonic Buffet Over NASA-CRM Using Cartesian-Grid-Based Flow Solver FFVHC-ACE | 1044 |
| <i>Yoshiharu Tamaki, Soshi Kawai</i> | |

| | |
|---|------|
| Simulating Buffet Aerodynamics of a Hammerhead Model Using Hybrid RANS-LES CFD Modeling | 1060 |
| <i>Andrew P. Voegele, Matthew Sirignano</i> | |

| | |
|---|------|
| Influence of Reynolds Number on Transonic Buffet Conditions on a Supercritical Airfoil..... | 1083 |
| <i>Christopher J. Schauerte, Anne-Marie Schreyer</i> | |

FLOW CONTROL APPLICATIONS INCLUDING EXPERIMENT AND COMPUTATION III

| | |
|--|------|
| Controlled Loads on an Axisymmetric Platform at High Incidence Using Forebody Aerodynamic Bleed..... | 1102 |
| <i>Edward Lee, Bojan Vukasinovic, Ari Glezer</i> | |

| | |
|--|------|
| Aerodynamic Assessment of Surface-Normal Active Flow Control for Lift Enhancement on the High-Lift Common Research Model | 1124 |
| <i>Seyedeh Sheida Hosseini, Case P. Van Dam, Shishir Pandya</i> | |

| | |
|--|------|
| Numerical Simulation of Discrete Co-Flow Jets NACA-6415 Airfoil..... | 1140 |
| <i>Zhijin Lei, Gecheng Zha</i> | |

| | |
|---|------|
| Near Wake Evolution of a Flexible Aerodynamically-Adaptive Wing Controlled by Distributed Bleed Actuation | 1153 |
| <i>Gabriel Peyredieu Du Charlat, Luca De Beni, Massimo Ruzzene, Ari Glezer</i> | |

HYPERSONIC AERODYNAMICS I

| | |
|---|------|
| Wall-Modeled Large-Eddy Simulations of Mach 14 Turbulent Boundary Layer - Aero-Optical Distortions | 1173 |
| <i>Pedro Castillo Gomez, Andreas Gross, Daniel R. Guildenbecher, Nathan E. Miller, Kyle P. Lynch</i> | |
| Aerodynamic Effects and Heat Flux Augmentation of a Transpiration Cooled Hypersonic Sharp Leading Edge..... | 1186 |
| <i>Raghul Ravichandran, Luke J. Doherty, Matthew McGilvray, Kyle Damm, Rowan Gollan</i> | |
| CFD Integrated Transition Modeling for High-Speed Flows Via Coupled OVERFLOW-LASTRAC Analysis | 1215 |
| <i>Ethan Vogel, Balaji S. Venkatachari, Pedro Paredes, Fei Li, Meelan M. Choudhari</i> | |
| Second-Mode Instability Investigation of a 7° Cone at Mach 6..... | 1250 |
| <i>Adelbert A. Francis, Cassandra J. Butler, Joseph S. Jewell</i> | |

SPECIAL SESSION: HPC MULTI-PHYSICS CREATE IV

| | |
|--|------|
| Computational Study of Ring-Slot Parachute Dynamics in Turbulent Flow Fields | 1264 |
| <i>Keith Bergeron, Mehdi Ghoreyshi, Adam Jirasek</i> | |
| Demonstrations of Design Cases with Transition Modeling in Helios..... | 1281 |
| <i>Christopher J. Axten</i> | |
| Roughness Wall Modeling for Naval Applications in CREATE™-AV Kestrel as Modified by NSWCCD..... | 1311 |
| <i>Theo Leasca, Andrew S. Dejong</i> | |
| A Prototype Incompressible Pressure-Based Solver for Free-Surface Flows in CREATE™-AV Kestrel | 1329 |
| <i>Matthew B. Jemison, Paul F. White, Andrew S. Dejong, Chandrasekhar Kannepalli, Wesley M. Wilson, Jacob B. Engel, Robert Starr</i> | |

SPECIAL SESSION: SLS AERODYNAMICS III

| | |
|--|------|
| Space Launch System Core Stage Green Run Base Heating: Anomaly, Mitigation and Flight Redesign | 1349 |
| <i>Manish Mehta, Christopher I. Morris, Brandon L. Mobley, Terry L. Prickett</i> | |
| Predicting SLS Launch Environment Using a Novel Multiphase Formulation..... | 1408 |
| <i>Jordan B. Angel, Scott Neuhoff, Man Long Wong, Michael F. Barad, Cetin C. Kiris</i> | |

VOLUME 3

| | |
|---|------|
| Validation of Shadowgraph Spectral Analysis Using an SLS Block 2 Wind-Tunnel Model..... | 1438 |
| <i>Oleg Goushcha, Martin K. Sekula, Theodore J. Garbeff</i> | |
| Comparison of Corcos-Based and Experimentally-Derived Coherence Factors for Buffet Forcing Functions Estimation | 1450 |
| <i>Francesco Soranna, Patrick S. Heaney, Martin K. Sekula, David J. Piatak, James M. Ramey</i> | |

| | |
|---|------|
| Experimental and Computational Examination of the Coandă Effect on the Space Launch System at Liftoff Conditions..... | 1473 |
| <i>Thomas J. Wignall, Morgan A. Walker, Jesse G. Collins</i> | |

TRANSONIC AND SUPERSONIC AERODYNAMICS III

| | |
|---|------|
| Strip Theory Approach to Corner Effects in Shock-Wave Boundary Layer Interactions | 1496 |
| <i>Rhys D. Williams, Holger Babinsky</i> | |
| Corner Effects on Oblique Shock Wave Boundary Layer Interactions in Rectangular Channels..... | 1518 |
| <i>Timothy Missing, Holger Babinsky</i> | |
| Vortex Interaction in Transonic Flow for Wing-Mounted UHBR Nacelles..... | 1540 |
| <i>Sebastian Spinner, Ralf Rudnik</i> | |
| Numerical Study on Suppression of Reentry Capsule Dynamic Instability in Transonic Flow | 1552 |
| <i>Yasuhito Okano, Shintaro Sato, Naofumi Ohnishi, Hiroki Nagai</i> | |

AERODYNAMIC DESIGN OPTIMIZATION

| | |
|--|------|
| A Convex Optimization Approach to Thin Airfoil Design Using Cubic Splines..... | 1565 |
| <i>Daniel Berkenstock, Juan J. Alonso, Laurent Lessard</i> | |
| Hybrid Fidelity Optimization of Efficient Airfoils and Rotors in Ultra-Low Reynolds Numbers Conditions | 1580 |
| <i>Manuel Carreno Ruiz, Domenic D'Ambrosio</i> | |
| Multi-Fidelity Probabilistic Aerodynamic Database Generation with the ProForMA Tool..... | 1596 |
| <i>Michael Cunningham, Nikhil Nigam, Jayant Mukhopadhaya, Juan J. Alonso, Sritharan Ayyalasomayajula</i> | |

FLOW CONTROL APPLICATIONS INCLUDING EXPERIMENT AND COMPUTATION IV

| | |
|--|------|
| Flow Field of a NACA-0010 Airfoil with Leading-Edge and Surface Modifications..... | 1614 |
| <i>Cesar A. Leos, Alejandro Carrizales, Robert Freeman, Isaac Choutapalli</i> | |
| Flow Control for Enhanced Aileron Effectiveness on a Commercial Aircraft | 1622 |
| <i>Arvin Shmilovich, Yoram Yadlin, Paul M. Vijgen, Rene Wosidlo</i> | |
| Applications of Flow Control to Wing High-Lift Leading Edge Devices on a Commercial Aircraft..... | 1646 |
| <i>Arvin Shmilovich, Yoram Yadlin, Paul M. Vijgen, Rene Wosidlo</i> | |
| Conceptual Integration Studies of Localized Active Flow Control on the Wing of a Commercial Aircraft | 1665 |
| <i>Paul M. Vijgen, Alex Ziebart, Arvin Shmilovich, Rene Wosidlo</i> | |
| Separation Control and the Energy Expenditure Using Pulsed Co-Flow Jet..... | 1687 |
| <i>Kewei Xu, Gecheng Zha</i> | |

HYPERSONIC AERODYNAMICS II

| | |
|---|------|
| Implicit Large Eddy Simulation of Hypersonic Boundary-Layer Transition for a Flared Cone..... | 1710 |
| <i>Cuong Nguyen, Sebastien Terrana, Jaime Peraire</i> | |

| | |
|--|------|
| 3D-Printed Quasi-Random Distributed Roughness for Turbulent Boundary Layer Analysis on Hypersonic Ogive Nosecones..... | 1725 |
| <i>Jack Shine, Joel White, Rodney D. Bowersox, Edward B. White, Mark T. Gragston, Farhan Siddiqui</i> | |

| | |
|---|------|
| Visualization of Surface Heat Transfer Around Sharp-Fin on Hypersonic Flat Plate at Various Angles of Attack..... | 1748 |
| <i>Masato Taguchi, Masashi Kashitani</i> | |

FLUTTER AND LIMIT CYCLE OSCILLATION PROBLEMS III - AEPW (AEROELASTIC PREDICTION WORKSHOP)

| | |
|---|------|
| Investigation of Geometrically Nonlinear Effects in the Aeroelastic Behavior of a Very Flexible Wing..... | 1762 |
| <i>Cristina Riso, Carlos E. Cesnik</i> | |

| | |
|--|------|
| Stall Flutter of the Benchmark Supercritical Wing at High Angles of Attack | 1783 |
| <i>Lior Poplinger, Daniella E. Raveh</i> | |

| | |
|---|------|
| Uncertainties Quantification in the Prediction of the Aeroelastic Response of the PAZY Wing Tunnel Model..... | 1797 |
| <i>Marcello Righi</i> | |

| | |
|---|------|
| Aerodynamic and Static Coupling Simulations of the Pazy Wing with Transitional CFD for the Third Aeroelastic Prediction Workshop..... | 1811 |
| <i>Markus Ritter, Michael Fehrs, Christoph Mertens</i> | |

SPECIAL SESSION: HPC MULTI-PHYSICS CREATE V

| | |
|---|------|
| Kestrel KCFD and FUN3D Results for the Fourth High Lift Prediction Workshop | 1833 |
| <i>Andrew J. Lofthouse</i> | |

| | |
|---|------|
| Evaluation of the Turbulence Models in CREATE™-AV Kestrel for High-Mach Flows | 1848 |
| <i>Brian J. Burke, William C. Tyson, Robert H. Nichols</i> | |

| | |
|---|------|
| Uncertainty Quantification of Tiltrotor Download Prediction..... | 1866 |
| <i>Manas Khurana, Buvana Jayaraman, Andrew M. Wissink, Rohit Jain</i> | |

AERODYNAMIC TESTING: GROUND, WIND-TUNNEL AND FLIGHT TESTING I

| | |
|--|------|
| Real-Scale Atmospheric Wind and Turbulence Replication Using a Fan-Array for Environmental Testing and UAV/AAM Validation..... | 1884 |
| <i>Aurélien Walpen, Guillaume Catry, Flavio Noca</i> | |

| | |
|---|------|
| Off-Board Aerodynamic Measurements of Small-UAVs in Glide and Powered Flight Using Motion Tracking..... | 1914 |
| <i>Mohamed El Mehdi Ouhabi, Shreyas Narsipur, Jichul Kim</i> | |

| | |
|--|------|
| Wind Tunnel Testing of an Aeroelastically Tailored Horizontal Stabilizer..... | 1935 |
| <i>Ronald C. Cheung, Djamel Rezgui, Jonathan E. Cooper, Richard Green, Raul C. Llamas-Sandin</i> | |

HYPERSONIC AERODYNAMICS III

| | |
|---|------|
| Rapid Hypersonic Sonic Boom Prediction Using Line-Distributed Energy Impulse Formulations with and Without Lift Effect..... | 1967 |
| <i>Shufan Zou, Zachary M. Johnston, Graham V. Candler, Suo Yang</i> | |
| Assessment of Optical Propagation Models with Application to Hypersonic Entry | 1989 |
| <i>Anubhav Gupta, Pol Mesalles Ripoll, Nicholas S. Campbell, Brian Argrow</i> | |
| Hypersonic Boundary-Layer Stability with Local Cooling and Local Metasurface Treatment..... | 2001 |
| <i>Furkan Oz, Kursat Kara</i> | |
| Elevon-Cove Pressure Fluctuations in a Quiet Mach-6 Flow..... | 2022 |
| <i>Adam C. Lay, Brandon C. Chynoweth, Joseph S. Jewell</i> | |

SPECIAL SESSION: NATO/STO

| | |
|---|------|
| Introduction to AVT-351: Enhanced Computational Performance and Stability & Control Prediction for NATO Military Vehicles | 2035 |
| <i>Mario Stradtner, David Drazen, Michel Van Rooij</i> | |
| Reynolds Number Effects on Transonic Designed Multi-Swept Combat Wing at Subsonic & Supersonic Speeds..... | 2064 |
| <i>Raj Nangia, Mehdi Ghoreyshi, Michel Van Rooij</i> | |
| Development of an Unsteady Indicial Response Model for Submarine Maneuvering..... | 2081 |
| <i>Craig J. Marshall, Tiger Jeans, Andrew Gerber, Robert Doyle</i> | |

SPECIAL SESSION: HIGH LIFT COMMON RESEARCH MODEL ECOSYSTEM

| | |
|--|------|
| Test Summary of the Full-Span High-Lift Common Research Model at the ONERA F1 Pressurized Low-Speed Wind Tunnel..... | 2097 |
| <i>Sylvain Mouton, Grégoire Charpentier, Annabelle Lorenski</i> | |
| Design of the 6% Boeing High-Lift Common Research Model (CRM-HL)..... | 2122 |
| <i>Kolleen Hood</i> | |

EXPERIMENTAL AND COMPUTATIONAL PROBLEMS OF HIGH-SPEED FSI II

| | |
|--|------|
| Aeroelastic Experiments and Companion Computations Assessing the Impact of Impinging Shock Sweep | 2135 |
| <i>Kirk R. Brouwer, Ricardo Perez, Timothy J. Beberniss, Stephen M. Spottswood</i> | |

VOLUME 4

| | |
|--|------|
| Boundary-Layer Measurements for FTSI Systems: Influence of Panel Flutter on a Mach 2 Turbulent Boundary-Layer..... | 2164 |
| <i>Scott J. Peltier, Kirk R. Brouwer, Ricardo Perez, Stephen M. Spottswood, Stephen Hammack</i> | |
| Combined Stereo Digital Image Correlation and Infrared Measurements of a Notional Mach 5 Aircraft Panel in the NASA 8-Foot High-Temperature Wind Tunnel..... | 2190 |
| <i>Timothy J. Beberniss, David A. Ehrhardt</i> | |

| | |
|--|------|
| Design of Aerothermoelastic Experiments in the AFRL Mach 6 High Reynolds Number Facility | 2211 |
| <i>Zachary B. Riley, Ricardo Perez, Kirk R. Brouwer</i> | |

TOPICS IN APPLIED AERODYNAMICS I

| | |
|---|------|
| In Silico Studies on Pintle Nozzle with Lucrative SITVC by Creating Sanal Flow Choking and Unchoking Conditions..... | 2227 |
| <i>Sai Shankaran B, Deviparameswari Krishnasamy, Haribalan ., Akshay Kumar Nandhan, Vigneshwaran Rajendran, Prisha K. Asher, Vr Sanal Kumar</i> | |
| Improved Area Ruling Via Hourglass Cross-Sectional Cuts | 2240 |
| <i>Patrick E. Rodi, Anish Chitnis</i> | |
| Computational Fluid Dynamics Study on the Effect of Using an Under-Tray Addition to Motorsport | 2261 |
| <i>Aaron Ocken, Ramesh K. Agarwal</i> | |
| Effect of Active Flow Control on Longitudinal Stability Characteristics..... | 2268 |
| <i>Naveed Tahir, Adnan Maqsood</i> | |
| Use of an Aerodynamic Wake Emulator to Assess the Impact on a High-Performance Ground Vehicle in Close Proximity..... | 2288 |
| <i>Jordi Cardona, Anderson Proenca, Kevin P. Garry</i> | |

UNSTEADY AERODYNAMICS III

| | |
|---|------|
| Some Considerations for Large Angle Unsteady Thin Airfoil Theoretical Modeling | 2307 |
| <i>Huai-Te Yu</i> | |
| Detached Eddy Simulation of Unsteady Flow Over a Frontal Cavity..... | 2326 |
| <i>Samruddhi P. Salunke, Suryapratap S. Shinde, Ishika A. Singh, Devabrata Sahoo, Ashish Vashishtha</i> | |
| High-Fidelity Flight Dynamic Analysis of Transonic Truss-Braced Wing..... | 2336 |
| <i>Nhan T. Nguyen, Juntao Xiong</i> | |
| An Approach to Determine Periodic Solutions of Nonlinear Inviscid Unsteady Aerodynamic Systems..... | 2367 |
| <i>Anshuman Mehta, Abhijit Gogulapati</i> | |
| Numerical Simulation of Pulsed Laser Energy Deposition in Viscous Supersonic Flow Over a Half-Cylinder..... | 2385 |
| <i>Anurag Chauhan, Rohan Pattankar, Shankar Ghosh</i> | |

TOPICS IN APPLIED AERODYNAMICS II

| | |
|---|------|
| A Different Intermittency Formulation for Flow at Low Reynolds Numbers | 2398 |
| <i>David Nixon</i> | |
| Computational and Analytical Investigation of the Effect of Protrusion Generated Shock Reflections on Intake Flow Performance | 2409 |
| <i>Mannat Sharma , Aishwarya M. Upadhye, Piyush Munishwar, Satvi Sanghani, Vignesh Ram Petha Sethuraman, Devabrata Sahoo</i> | |

| | |
|--|------|
| 3D Effects of Doors on Cavity Bay Dynamics..... | 2421 |
| <i>Skyler K. Baugher, Datta V. Gaitonde</i> | |
| Domain-Decomposed Reduced-Order Modelling of Steady Aerodynamics for 2D Store Separation Analysis..... | 2453 |
| <i>Navdeep Pandey, Rohit Tembhare, Nisha Singh, Aniruddha Sinha</i> | |
| Upstream Turbulence Effects on the Self-Similarity of Wakes: Vortex Pair Dynamics | 2467 |
| <i>Prasanth K. Murari, Anderson Proenca, Kevin P. Garry</i> | |

APPLIED COMPUTATIONAL FLUID DYNAMICS I

| | |
|--|------|
| RANS Computations of 3D Flow Past NASA Common Research Model in High Lift Configuration..... | 2488 |
| <i>Karsten Hendrickson, Ramesh K. Agarwal</i> | |
| Computational Fluid Dynamics Study of Modification to Front Wing Endplate of FSAE Race Car for Drag Reduction..... | 2505 |
| <i>Haowei Wu, Ramesh K. Agarwal</i> | |
| Direct Numerical Simulations of Tandem Wings at Low Reynolds Number | 2515 |
| <i>Chenchen Zhao, Hongyi Xu</i> | |

PROPELLER/ROTORCRAFT/WIND TURBINE AERODYNAMICS I

| | |
|--|------|
| Effect of Axial Spacing and Rear-Propeller Pitch on Performance of Coaxial Propellers | 2530 |
| <i>Kian Conroy, Konstantin Matveev</i> | |
| Aerodynamic and Aeroacoustic Investigation for the Operation Arrangement of Contra-Rotating Rotors | 2540 |
| <i>Pengyu Li, Yannian Yang, Haoyu Zhang, Yu Liu, Xuanwu Chen, Qingxi Li</i> | |
| Comparison of Small Multirotor Wake Vortex of Different Weight Class and Rotor Configurations Via Numerical Simulation | 2553 |
| <i>Chung Hung J. Wang, Joshua C. Nathanael, Kin Huat Low</i> | |

SPECIAL SESSION: DATA-DRIVEN UNCERTAINTY QUANTIFICATION IN REENTRY AERODYNAMICS I

| | |
|---|------|
| AeroFusion: Data Fusion and Uncertainty Quantification for Entry Vehicles..... | 2561 |
| <i>Steven Snyder, Thomas J. Wignall, Justin S. Green, Satvik Kumar, Michael W. Lee, Tenavi Nakamura-Zimmerer, James B. Scoggins, Robert A. Williams</i> | |
| Comparisons of Performance Metrics and Machine Learning Methods on an Entry Descent and Landing Database | 2570 |
| <i>Thomas J. Wignall, Tenavi Nakamura-Zimmerer, James B. Scoggins, Steven Snyder, Satvik Kumar, Brendon K. Colbert</i> | |
| Structured Covariance Gaussian Networks for Orion Crew Module Aerodynamic Uncertainty Quantification..... | 2591 |
| <i>Tenavi Nakamura-Zimmerer, Mary T. Stringer, Brendon K. Colbert, James B. Scoggins</i> | |
| Multihierarchy Gaussian Process Models for Probabilistic Aerodynamic Databases Using Uncertain Nominal and Off-Nominal Configuration Data | 2607 |
| <i>James B. Scoggins, Thomas J. Wignall, Tenavi Nakamura-Zimmerer, Karen L. Bibb</i> | |

Construction of a Fluid Flow Field from Discrete Point Data Using Machine Learning 2632
Yury Lebedev, Michael W. Lee, Alina Zare

SPECIAL SESSION: ROTOR-IN-HOVER SIMULATION I

A Common Simulation for Hover Validation of a Helicopter Near the Ground..... 2644
Robert P. Narducci, Nathan S. Hariharan

Model and Full-Scale Rotor Hover Performance Analysis Using HELIOS/OVERFLOW 2661
Vera Klimchenko, Byung-Young Min, Brian Wake

Numerical Analysis of HVAB and STAR Rotor Blades Using HMB3..... 2673
Rinaldo Steininger, George N. Barakos, Mark A. Woodgate

AERODYNAMIC TESTING: GROUND, WIND-TUNNEL AND FLIGHT TESTING II

Hypersonic Ground Tests of BOLT II Using Optical Diagnostics..... 2690
Jacob G. Butera, Cary D. Smith, John D. Schmisser

Experimental Characterization of the Base Flow of a Slender Cone at Supersonic Speeds 2702
Noah Moffeit, Rajan Kumar, Jonas Gustavsson

AERO-STRUCTURAL INTERACTIONS

Shock Migration on an Oscillating Straked Delta Wing Using an Unsteady Euler Solver 2714
Alexander Brown, Donald L. Kunz

Aerostructural Predictions Combining FEniCS and a Viscous Vortex Particle Method..... 2736
Ryan Anderson, Andrew Ning, Ru Xiang, Sebastiaan P. Van Schie, Mark Sperry, Darshan Sarojini, David Kamensky, John T. Hwang

Bifurcation Analysis of an Aeroelastic System Under Flight Varying Conditions: A Hybrid Approach 2749
Jesús García Pérez, Amin Ghadami, Leonardo Sanches, Guilhem Michon, Bogdan Epureanu

The Effect of Structural Characteristics on Transonic Buffeting..... 2758
Tim Korthäuer, Alessandro Accorinti, Sven Scharnowski, Christian Kähler

Aeroelastic Analysis of Transonic Flutter with CFD-Based Reduced-Order Model 2767
Ana N. Carloni, João Luiz F. Azevedo

SPECIAL SESSION: DATA-DRIVEN UNCERTAINTY QUANTIFICATION IN REENTRY AERODYNAMICS II

Parametric Studies of Subsonic and Supersonic Reentry Phases of the Orion Crew Module Through Numerical Simulations 2782
Jonas Buchmeier, Fnu Himanshu, Donya Ramezani, Ivan Bermejo-Moreno

Quantifying Emergent Fluid Dynamics Using Reynolds-Interpolated Fluid Reduced-Order Models 2797
Chris Edwards, Michael W. Lee, Donya Ramezani, Ralph Smith

Application of an Affine Nonlinear Galerkin Reduced-Order Model to Compressible Fluid Flows2811
Donya Ramezani, Michael W. Lee, Ivan Bermejo Moreno

Low-Cost Quantification of Fluid Flow Parameter Sensitivity Using Reduced-Order Modeling 2832
Harley W. Hanes, Michael W. Lee, Donya Ramezani, Ralph Smith

Optimal Sensor Placement in Fluid Dynamics Using Machine Learning and Sensitivity Analysis 2849
Harley W. Hanes, Yury Lebedev, Ralph Smith, Alina Zare

SPECIAL SESSION: ROTOR-IN-HOVER SIMULATION II

Effects of Anedral Tip on Hover Performance 2857
Shivani Shankar, Lakshmi N. Sankar, Po-Wei Chen

VOLUME 5

A Coupled Source Panel, Actuator Line, and Viscous Vortex Particle Method in an O(n) Scheme 2870
Ryan Anderson, Andrew Ning

An Application of the Flow360 Solver to the Hover Download Prediction Problem 2889
Thomas A. Fitzgibbon, Charles J. Doolittle, Qiqi Wang, Philippe Spalart

HYPERSONIC AERODYNAMICS V

Large Eddy Simulation of Transitional and Turbulent Hypersonic Flow 2913
Natan Hoffmann, Amareshwara S. Chamarthi, Hemanth Chandra Vamsi Kakumani, Steven Frankel

Visualization and Measurement of Transverse Jet Injection on a 7 Degree Half-Angle Cone in Hypersonic Quiet Flow 2936
Christopher C. Chinske, Zachary D. Lawless, Robert N. Blackwell, Joseph S. Jewell

Wind-Tunnel Based Free-Flight Testing of a Viscous Optimised Hypersonic Waverider 2949
Jeremy H. Moran, Liam P. McQuellin, Luke Pollock, Andrew J. Neely, David Munk, Fabian Zander

Rebuilding the VKI's Experiment on the Interference of a Free-Flying Ring and Stationary Cylinder Using a Multi-Fidelity Numerical Methodology 2969
Fábio Morgado, Marco Fossati, Dániel Kóvacs, Thierry Magin

Numerical Simulations of Hypersonic Flows Over the Fire II Capsule: Impact of Mesh Resolution and Boundary Conditions on Convective Heat Transfer 2979
Farney C. Moreira, William Wolf, João Luiz F. Azevedo

AIRFOIL/WING/CONFIGURATION AERODYNAMICS V

Goal-Oriented Adaptive Sampling Procedure for Projection-Based Reduced-Order Models for Aerodynamic Flows 2991
Donovan Blais, Sivakumaran Nadarajah

Roll Performance of a Flexible Aircraft with Active Aeroelastic Wing 3003
Adithya K. Mayya, Ashish Srivastava, Madhusudan A. Padmanabhan, Kartik Venkatraman

Transonic Buffet in the Benchmark Supercritical Wing 3018
Magan Singh, Kartik Venkatraman

Two-Dimensional Transonic Buffet in a Supercritical Wing Section 3028
Md Arif, Magan Singh, Pradeepa T. Karnick, Kartik Venkatraman

RANS Sensitivity Study and Global Stability Analysis of the NASA Common Research Model
High-Lift Configuration 3047
Markus Zauner, Andrea Sansica, Yoimi Kojima, David J. Lusher, Atsushi Hashimoto

APPLIED COMPUTATIONAL FLUID DYNAMICS II

Numerical Simulation of Separated Flows Using Entropic Lattice Boltzmann Method 3061
Syed A. Rizvi, Chakradhar Thantanapally, Salvatore Arcidiacono, Santosh Ansumali

Implementation of γ - Re_{θ} Transition Model Within SU2: Model Validation and Verification..... 3067
Andrea Rausa, Alberto Guardone, Franco Auteri

Longitudinal Dynamic Stability Derivatives for Flying Wing Configuration 3090
Cagri A. Metin, Mustafa K. Uzuner, Yunus E. Muslubas, Volkan Kargin

Large Eddy Simulation Studying Unsteady Coflow Jet Flow Control for a NACA6421 Airfoil..... 3105
Philip E. Morgan, Daniel J. Garmann, Miguel R. Visbal

TOPICS IN APPLIED AERODYNAMICS III

Wind-Tunnel Wall Interference Investigation of an Aspect Ratio 13.5 Common Research Model
Using FUN3D..... 3122
Juntao Xiong, Nhan T. Nguyen, Robert E. Bartels

Jig Twist Optimization of Mach 0.8 Transonic Truss-Braced Wing Aircraft..... 3137
Juntao Xiong, Nhan T. Nguyen, Robert E. Bartels

Lifting-Line Predictions for Lift and Twist Distributions to Minimize Induced Drag in Ground
Effect 3154
Kyler Church, Douglas F. Hunsaker

Aeroelastic Trim Drag Optimization of Mach 0.8 Transonic Truss-Braced Wing Aircraft Using
High-Lift Devices and Control Surfaces 3190
Juntao Xiong, Nhan T. Nguyen, Robert E. Bartels

Numerical Investigations of Shock/Boundary-Layer Interaction Control for a Mach 2.5 Flow in an
Axisymmetric Inlet..... 3206
Mohd S. Khan, Jatinder Pal Singh Sandhu, Santanu Ghosh, Jack R. Edwards

SPECIAL SESSION: NASA SUSAN AIRCRAFT CONCEPT TRADE STUDY UPDATE I

Preliminary Assessment of a Distributed Electric Propulsion System for the SUSAN Electrofan 3229
Leonardo M. Machado, Timothy Chau, Gaetan K. Kenway, Jared C. Duensing, Cetin C. Kiris

SUSAN Concept Vehicle Power and Propulsion System Study..... 3247
Jeffryes W. Chapman, Jonathan L. Kratz, Timothy Dever, Arman Mirhashemi, Nicole Heersema, Ralph Jansen

| | |
|--|------|
| Control Architecture for a Concept Aircraft with a Series/Parallel Partial Hybrid Powertrain and Distributed Electric Propulsion | 3264 |
| <i>Jonathan S. Litt, Jonathan L. Kratz, Santino Bianco, Jonah Sachs-Wetstone, Timothy Dever, Halle E. Buescher, Nicholas C. Ogden, Felipe Valdez, Daniel W. Budolak, Matthew J. Boucher, Andrew P. Patterson, Ralph Jansen</i> | |

| | |
|--|------|
| Flightcrew Thrust Control and Engine Display Concepts for the Subsonic Single Aft Engine (SUSAN) Transport Aircraft..... | 3280 |
| <i>Jarvis J. Arthur, Kellie D. Kennedy, Timothy J. Etherington, Jonah Sachs-Wetstone, Jonathan S. Litt, A. Karl Owen</i> | |

PROPULSION AERODYNAMICS AND AERO-PROPULSIVE INTERACTIONS I

| | |
|--|------|
| Experimental Wind Tunnel Investigation on Propeller-Wing Interactional Aerodynamics..... | 3299 |
| <i>Shreyas Srivathsan, Juergen Rauleder</i> | |

| | |
|--|------|
| Analytical Framework for Design of Aero-Propulsive Geometries with Powered Wakes | 3319 |
| <i>Himavath Jois, Phillip J. Ansell</i> | |

| | |
|---|------|
| Full Stall Simulations of a Redesigned Ventilation Fan for the International Space Station..... | 3334 |
| <i>Branden A. Butler, Carlos A. Valentin, Michael R. Borghi, Mark G. Turner</i> | |

REDUCED ORDER AERODYNAMIC MODELING AND SYSTEM IDENTIFICATION I

| | |
|---|------|
| Local Basis Approach for the Reduction of CFD-Based Embedded Boundary Models..... | 3349 |
| <i>Noah Youkilis, Charbel Farhat</i> | |

| | |
|--|------|
| Deep Learning for Realistic Wind Field Prediction in a Typical Urban Morphology for Application to Small Unmanned Aerial Systems | 3362 |
| <i>Rohit K S S Vuppala, Kursat Kara</i> | |

APPLIED COMPUTATIONAL FLUID DYNAMICS III

| | |
|--|------|
| Toward Ultra-High Cruise Lift Coefficient Using Flapped Coflow Jet Airfoil | 3373 |
| <i>Jaehyoung Jeon, Yan Ren, Gecheng Zha</i> | |

| | |
|--|------|
| Prediction Accuracy of RANS-Based Analysis for Aerodynamic Forces and Moments of a Civil Aircraft Model..... | 3391 |
| <i>Kohei Konishi, Yoimi Kojima, Atsushi Hashimoto, Masaharu Kameda</i> | |

| | |
|--|------|
| Mixed-Element USM3D Contributions to the 4th AIAA High Lift Prediction Workshop..... | 3400 |
| <i>Michael D. Bozeman, Mohagna J. Pandya</i> | |

| | |
|----------------------------|------|
| The CFFD Equivalence | 3427 |
| <i>Ronald M. Deslandes</i> | |

| | |
|---|------|
| Modelling Effect of Rain on the External Aerodynamics of the Utility Truck with the Morphing Boom Equipment: Computations and Wind Tunnel Testing | 3438 |
| <i>Parth Y. Patel, Chandramouli Krishnamurthy, Gavin Clausman, Vladimir Vantsevich, Roy Koomullil</i> | |

SPECIAL SESSION: DRAG REDUCING SURFACES I

- Materials and Performance Testing of DCM Drag-Reducing Riblets for Aviation 3454
*Henry C. Bilinsky, Mitchell S. Quinn, Dylan McGrath, John Whitelock, Swapnil Poudyal,
Duncan C. Bell, Christoph Feichtinger, Peter A. Leidl, Richard Benauer*
- Computational Simulation of Staggered 3-D Riblets for Skin Friction Drag Reduction..... 3464
Brian R. Smith, Patrick Yagle, Paul D. McClure
- Numerical Study of Riblet Defects and Their Impact on Performance 3476
Peter A. Leidl, Christoph Feichtinger, Georg Schatzdorfer, Andreas Flanschger
- Numerical and Experimental Investigation of Riblet Application on a Helicopter Rotor Blade 3488
*Peter A. Leidl, Dominik Kohl, Hirokazu Tsuchihashi, Richard Gruber, Karl Pichler, Yuta Goto,
Mikel L. Garcia De Albeniz, Kaneyuki Naito, Andreas Flanschger, Go Ichinose*

SPECIAL SESSION: NASA SUSAN AIRCRAFT CONCEPT TRADE STUDY UPDATE II

- Mission Profiles for the SUSAN Electrofan Concept..... 3502
Casey L. Denham, Timothy Chau, Wes Ryan, Ralph Jansen
- Structural Requirements for Design and Analysis of 25% Scale Subsonic Single Aft Engine
(SUSAN) Research Aircraft 3509
Lilia Miller, Ralph Jansen
- Thermal Requirements for Design and Analysis of Subsonic Single Aft Engine (SUSAN) Research
Aircraft 3527
Erik J. Stalcup, Nicole Heersema
- Market Analysis of the Subsonic Aft Engine (SUSAN) Transport Aircraft Concept 3538
Jacob M. Wishart, Kendall Mahavier, Ralph Jansen

PROPULSION AERODYNAMICS AND AERO-PROPULSIVE INTERACTIONS II

- Comparison of Aerodynamic Analysis Tools Applied to a Propeller-Blown Wing 3559
Vivek Ahuja, Brandon L. Litherland

VOLUME 6

- A Wind Tunnel Rig to Study the External Fan Cowl Separation Experienced by Compact Nacelles
in Windmilling Scenarios 3576
*Kshitij Sabnis, Luca Boscagli, Avery Swarhout, Fernando Tejero Embuena, Holger Babinsky,
David Macmanus, Christopher Sheaf*
- Discernment of Wall Functions and Turbulence Statistics for Common Supersonic Retropropulsion
Configurations 3596
Emily Jewell, Charbel Farhat

REDUCED ORDER AERODYNAMIC MODELING AND SYSTEM IDENTIFICATION II

| | |
|--|------|
| Improved Methods of Optimized Sparse Sensing for Yaw Angle Estimation and Surface Pressure Distribution Reconstruction Using Pressure-Sensitive Paint Data of Ground Vehicle | 3613 |
| <i>Ryoma Inoba, Kazuki Uchida, Yuto Iwasaki, Takayuki Nagata, Yuta Ozawa, Keisuke Asai, Taku Nonomura</i> | |
| Modeling Airfoil Dynamic Stall Using State-Space Neural Networks..... | 3622 |
| <i>Luca Damiola, Jan Decuyper, Mark Runacres, Tim De Troyer</i> | |
| System Identification and Control of a Circulation Control Airfoil for Gust Load Alleviation | 3631 |
| <i>Salvatore Asaro, Davide Cavaliere, Nicolas Fezans, André Bauknecht</i> | |
| Low Fidelity Modelling of the Nonlinear Aerodynamics of Spoilers | 3653 |
| <i>Alessandro Pontillo, Punsara Navaratna, Mark H. Lowenberg, Djamel Rezgui, Jonathan E. Cooper, Simon A. Neild</i> | |

APPLIED COMPUTATIONAL FLUID DYNAMICS IV

| | |
|--|------|
| A Numerical Investigation of the Dragonfly Lander Exiting an Aero Backshell During Descent into Titan..... | 3671 |
| <i>Corey A. Zucker, Luis Amaya, Wayne Farrell, Michael P. Kinzel</i> | |
| Prediction of Duct Airfoil Aerodynamics Using Surface Vorticity..... | 3695 |
| <i>Xiangpu Wang, Roy J. Hartfield, Vivek Ahuja</i> | |
| Computational Evaluation of a Damage Assessment Model for UAV Wings | 3711 |
| <i>Siddharth Chandra Shekar, Raymond P. Lebeau, Srikanth Gururajan</i> | |
| An Evaluation of a Sprayed Liquid Flap on a 3D Wind Turbine Blade | 3724 |
| <i>Alexander Spitzer, George E. Loubimov, Michael P. Kinzel</i> | |

SPECIAL SESSION: DRAG REDUCING SURFACES II

| | |
|--|------|
| Numerical and Experimental Investigation of Different Riblet Layouts on a Stratos 716 X Business Jet | 3737 |
| <i>Peter A. Leidl, John Smoker, Mikel L. Garcia De Albeniz, Andreas Flanschger</i> | |
| Wind Tunnel Test Results for Staggered 3-D Riblets | 3752 |
| <i>Paul D. McClure</i> | |

HYPERSONICS AND ENTRY FLOW PLASMAS I: EXPERIMENTS

| | |
|---|------|
| Use of Modified Radar REMPI for Localized Measurement of Temperature in Semiconductors | 3763 |
| <i>Christopher Grunbok, Richard Miles, Arthur Dogariu</i> | |
| Luminous Efficiency Determination of Spacecraft Materials in Ground Test Facilities | 3770 |
| <i>David Leiser, Christian A. Dürnhöfer, Stefan Loehle, Jérémie J. Vaubailon, Stefanos Fasoulas</i> | |
| Effect of Transport Coefficients on RAM-C-II Plasma Density..... | 3780 |
| <i>Prasanna Thoguluva Rajendran, Bernard Parent</i> | |

| | |
|--|------|
| Stabilization Effects in Hydromagnetic Plasma Flows..... | 3805 |
| <i>Thomas C. Underwood</i> | |

AERODYNAMIC TESTING: GROUND, WIND-TUNNEL AND FLIGHT TESTING III

| | |
|--|------|
| Experimental Investigation of Wing Rock on a Low Aspect Ratio Flying Wing Micro Aerial Vehicle Using Pyramidal Balance | 3815 |
| <i>Taimur A. Shams, Syed Irtiza Ali Shah, Muhammad Ayaz Ahmad, Aamer Shahzad, Syed Tauqeer Ul Islam Rizvi, Zahid Mehmood</i> | |
| Flight Performance Characteristics of a Modified Quadcopter with and Without a Wing Based on Flight Test..... | 3826 |
| <i>Shanfei Su, Yihan Mei, Yan Zhou, Xiaowen Shan, Peng Yu, Hao Wang</i> | |
| Aerodynamics and Flight Performance of a UAV in Ground Effect Based on Flight Simulation..... | 3843 |
| <i>Yan Zhou, Yihan Mei, Shanfei Su, Xiaowen Shan, Hao Wang</i> | |
| Expanded Flight & Ground Testing Data Set for an Unmanned Aircraft: Great Planes Avistar Elite | 3855 |
| <i>Or D. Dantsker, Marco Caccamo, Renato Mancuso</i> | |
| Ground Testing Facility for Scaled Thrust Reverser | 3874 |
| <i>Houbo Zhang, Jun Ji, Peng Li</i> | |

APPLIED COMPUTATIONAL FLUID DYNAMICS V

| | |
|---|------|
| GPU-Accelerated Simulations for eVTOL Aerodynamic Analysis..... | 3887 |
| <i>Vito Pasquariello, Yannick Bunk, Sebastian Eberhardt, Pei-Hsuan Huang, Jan Matheis, Matteo Ugolotti, Stefan Hickel</i> | |
| A Numerical Study of Rotor Blade Loading for Coaxial Rotors..... | 3909 |
| <i>Jose Urcia, Michael P. Kinzel, Wayne Farrell</i> | |
| Aero-Structural Analysis of Deployable Aeroshell in Transonic Flow..... | 3923 |
| <i>Sanjoy Kumar Saha, Yusuke Takahashi</i> | |
| Aerodynamic Comparison of Smooth Versus Bumpy Airfoil at Different Reynolds Number | 3940 |
| <i>Manish Tripathi, Sohrab R. Mistri, Rajkumar S. Pant</i> | |

BIO-INSPIRED AERODYNAMICS I

| | |
|---|------|
| Flight Performance of an Autorotating Samara with Varying Windspeed..... | 3956 |
| <i>Byungkwon Jung, Djamel Rezgui</i> | |
| Numerical Investigation of Hinged Flap Vs. Morphed Trailing-Edge at Low Reynolds Number | 3996 |
| <i>Ankit Kumawat, Santanu Ghosh</i> | |

HYPERSONIC AERODYNAMICS IV

| | |
|--|------|
| Computational Fluid Dynamics Analysis Over a Reentry Capsule at Mach 6 | 4016 |
| <i>Rakhab C. Mehta</i> | |
| Shock Interference Patterns on Double- Wedge Configurations for Pure CO ₂ Flows | 4032 |
| <i>Anurag A. Ray, Ashoke De</i> | |

Shock Reduction Through Multiple Opposing Jets in Atmospheric Entry Vehicle 4043
Huzaiifa Shahid, Adnan Maqsood, Dan Xie

Unsteady Supersonic Flow Over a 2-D Morphing Shock Control Bump Using Different Velocity Profiles 4060
Ahmed Hamada, Lubna Margha, Ahmed K. Alnemr, Mohamed Abdelrahman, Amr Guaily

AIRFOIL/WING/CONFIGURATION AERODYNAMICS I

Aerodynamic Buffet Onset Boundary Estimation of a Jet Trainer Aircraft..... 4074
Ali Oguz Yüksel, Ömer Kandemir, Levent Ugur, Yasar Ostovan, Erdem Ayan

Suppression of Flow Separation in the Slat Cut-Out Region of a High-Lift Wing with Active Flow Control..... 4091
Qiangqiang Sun, Faycal Bahri, Richard Jefferson-Loveday, Mark Jabbal

Towards Wall-Resolved Large Eddy Simulation of the High-Lift Common Research Model with a High-Order Method..... 4100
Zhi J. Wang, Nicholas J. Wyman, Kristen Karman-Shoemaker

SPECIAL SESSION: UNIVERSITY LEADERSHIP INITIATIVE FOR ULTRA-EFFICIENT AIRCRAFT I

Update on the Aerodynamic Performance Analysis of a SNLF-Enabled Transonic Truss Braced Wing4114
Khanh H. Pham, Leo L. Chou, Neal A. Harrison, Paul M. Vijgen, Abdollah Khodadoust

A Winglet Design Study for the Slotted, Natural-Laminar-Flow Strut-Braced Transport Aircraft..... 4128
Leonard P. Metkowski, Mark D. Maughmer

Investigating Fluidic Oscillators Embedded in a Slotted-Natural Laminar Flow Airfoil for High-Lift Applications..... 4144
Christopher Colletti, Phillip J. Ansell

OTHER TOPICS IN APPLIED AERODYNAMICS

Flow Structures of Ship Airwakes with Quartering Winds..... 4155
Kaijus H. Palm, Zheng Zhang, Ebenezer P. Gnanamanickam, John G. Leishman

Pressure Distributions for Bodies of Revolution in Compressible Flows Using an Advanced Panel Method 4173
William F. Collins, Roy J. Hartfield, Vivek Ahuja

Assessment of Quadrotor Near-Wall Behaviour Using Six-Degrees of Freedom CFD Simulations 4205
Manuel Carreno Ruiz, Nicoletta Bloise, Elisa Capello, Domenic D'Ambrosio, Giorgio Guglieri

Computational Methodology to Compute Unmanned Aircraft Deflections Due to Aerodynamic Interaction with a Commercial Aircraft..... 4221
Harsh Shah, Nidhi Sathyanarayana, Luis M. Gomez, Gerardo Olivares

APPLIED COMPUTATIONAL FLUID DYNAMICS VI

| | |
|--|------|
| Performance and Validation of a Segregated Pressure-Based Solver for Computations of Low and High-Speed Compressible Flows | 4237 |
| <i>Ashutosh Pandey, Junfeng Wang, Dipak Maiti, Yu Jiang</i> | |
| Assessment of Using Ideal Gas for Predicting Boattail Flow at Cryogenic Temperatures | 4260 |
| <i>Jan-Renee Carlson</i> | |
| Transonic Buffet Simulation Using Harmonic Balance Method | 4270 |
| <i>Andrea Petrocchi, George N. Barakos</i> | |

VOLUME 7

| | |
|--|------|
| Curvature-Based Adaptation Using Gradient Descent Optimization Applied to High-Speed Flows | 4287 |
| <i>Arjun J. Vedam, William Engblom</i> | |
| CFD-Based Kriging Surrogate Models Compared to Axisymmetric Missile Concept from Mach 0.60 to 3.95 | 4309 |
| <i>Zachary D. Lawless, Emily R. Dreyer, Clayton Smith</i> | |

LOW SPEED AND LOW REYNOLDS NUMBER AERODYNAMICS

| | |
|---|------|
| Effect of Turbulence Intensity on Time-Averaged Aerodynamics of NACA0012 Wing at Low Reynolds Numbers | 4329 |
| <i>Masataka Kase, Makoto Mizoguchi, Hajime Itoh</i> | |
| Utilizing a Spalart-Allmaras Turbulence Model Correction with a Transition Model | 4339 |
| <i>Christopher J. Axten, Mark D. Maughmer</i> | |

PROPELLER/ROTORCRAFT/WIND TURBINE AERODYNAMICS II

| | |
|--|------|
| Scaling of Hovering Rotorcraft Aerodynamics in Hyperbaric Experimental Conditions | 4359 |
| <i>Constantinos S. Kandias, Mark A. Miller</i> | |
| High-Fidelity Simulations of a Tiltwing Vehicle for Urban Air Mobility | 4370 |
| <i>David Garcia Perez, Patricia Ventura Diaz, Steven Yoon</i> | |
| Assessment of Methods for Propeller Performance Calculation at High Incidence Angles | 4396 |
| <i>Luiz F. Fernandez, Murat Bronz, Nathalie Bartoli, Thierry Lefebvre</i> | |
| Effect of Propeller Incidence Angle on Wing Embedded Propeller Configuration in Forward Flight | 4417 |
| <i>George J. Gogidze, Sidaard Gunasekaran, Jielong Cai</i> | |
| Flowfield Analysis of a Quadrotor in Forward and Maneuvering Flight Modes | 4435 |
| <i>Colin P. Britcher, Engin Baris</i> | |

AIRFOIL/WING/CONFIGURATION AERODYNAMICS II

| | |
|--|------|
| Three-Dimensional Viscous Coupling & Flow Separation Enhancements to an Inviscid Surface Vorticity Flow Solver | 4446 |
| <i>Vivek Ahuja, Roy J. Hartfield, Danilo Ciliberti</i> | |

| | |
|---|------|
| Aerodynamic Investigation of a Novel Diamond-Back Morphing Wing Configuration..... | 4468 |
| <i>Shiladitya Bhowmick, Rinku Mukherjee, V Kalyana Chakravarthy</i> | |
| Application of a Semi-Empirical Method to Model Subsonic Vortex Lift Over Sharp Leading-Edge Delta Wings | 4482 |
| <i>Daniel Huynh, Davide Di Pasquale, Simon Prince, Vivek Ahuja</i> | |
| Performance of Forward-Swept and Backward-Swept Stabilizers in a V-Tail Configuration..... | 4498 |
| <i>Ronald C. Cheung, Djamel Rezgui, Jonathan E. Cooper, Richard Green, Raul C. Llamas-Sandin</i> | |

BIO-INSPIRED AERODYNAMICS II

| | |
|--|------|
| A Preliminary Investigation into Icing Accretion Around a Wavy Leading-Edge Wing | 4511 |
| <i>Andrea Da Ronch, Gabriele Immordino, Jae Wook Kim</i> | |
| Computation Study About the Interaction Between the Tandem Flying Snake Airfoils with Dynamic Motion..... | 4535 |
| <i>Yuchen Gong, Haibo Dong</i> | |
| Experimental Investigation of Planar Swept Bio-Inspired Wing Planforms | 4548 |
| <i>Arnab Chatterjee, Tulasi Ram Vechalapu, Chang-Kwon Kang, Konstantinos Kanistras</i> | |
| Experimental Analysis of a Large-Scale Tandem Flapping Wing System..... | 4564 |
| <i>Thomas Lambert, Grigorios Dimitriadis</i> | |

PROPELLER/ROTORCRAFT/WIND TURBINE AERODYNAMICS III

| | |
|---|------|
| Vertically Offset Overlapping Propellers in Tandem Configuration..... | 4576 |
| <i>Jielong Cai, Sidaard Gunasekaran, Michael V. Ol</i> | |
| Fundamental Studies Towards Rotor Simulations and Design..... | 4592 |
| <i>Feilin Jia, Philippe Spalart, Maks J. Groom, Qiqi Wang</i> | |
| Comparison of Instantaneous Aerodynamic Loads on Sharp and Blunt Trailing-Edged Blades of High Advance Ratio Rotors..... | 4614 |
| <i>Oliver Wild, Matthew J. Murphy, Anya R. Jones</i> | |

HYPERSONICS AND ENTRY FLOW PLASMAS II: SIMULATION

| | |
|--|------|
| Numerical Analysis of Magnetohydrodynamic Flow Control in Mars Direct and Orbital Entries | 4628 |
| <i>Kotaro Tabuchi, Ryota Sumitomo, Kaito Tanaka, Takayasu Fujino</i> | |
| Feasibility of MHD Aerobraking for Use in Martian Atmospheric Entry | 4643 |
| <i>John C. Ogilvie, David Gildfind, Rowan Gollan, Nicholas N. Gibbons</i> | |
| Prediction of Communication Blackout and Degradation for a Re-Entry Hypersonic Capsule Through High-Fidelity Numerical Simulations..... | 4668 |
| <i>Henry H. Vu, Valerio Viti, Jeff Tharp, Eldon Staggs</i> | |
| Optimised Magnetic Field Strengths for Venus Atmospheric Entry Using Magnetohydrodynamic Aerobraking..... | 4683 |
| <i>Sebastiaan B. Van Oeveren, David Gildfind</i> | |

SPECIAL SESSION: NATO AVT-297

| | |
|---|------|
| AVT-297 Development of a Framework for Validation of Computational Tools | 4706 |
| <i>Joseph H. Morrison, Melike Nikbay, Eric L. Walker</i> | |
| Exploitation of a Validation Hierarchy for Modeling and Simulation | 4718 |
| <i>Scott Shaw, James M. Luckring, William Oberkampf, Rick E. Graves</i> | |
| A Process for Identifying Requirements for Physical Referent Data to Support Computational Model Validation | 4737 |
| <i>Nigel J. Taylor, Dimitri N. Mavris, Efe Yamac Yarbasi, Burak Bagdatli</i> | |
| A Systems Engineering Based Model Selection Approach for Complex, Multi-Disciplinary Physics Problems | 4763 |
| <i>Efe Yamac Yarbasi, Burak Bagdatli, Dimitri N. Mavris</i> | |

AIRFOIL/WING/CONFIGURATION AERODYNAMICS IV

| | |
|--|------|
| Simulation of 3D Co-Flow Jet Airfoil with Integrated Micro-Compressor Actuator at Different Cruise Mach Numbers | 4788 |
| <i>Paula A. Barrios, Yan Ren, Gecheng Zha</i> | |
| Design of Laminar-Flow Airfoils Based on Boundary-Layer Integral Parameters | 4808 |
| <i>Armando R. Collazo Garcia, Phillip J. Ansell</i> | |
| Numerical Study of Co-Flow-Jet Distribution Along the Span of Finite Wing | 4828 |
| <i>Zhijin Lei, Gecheng Zha</i> | |
| Flight Dynamics of a Flying Wing Aircraft Featuring the Bell Spanload | 4845 |
| <i>Caleb S. Robb, Rohit K S S Vuppala, Ryan C. Paul, Kursat Kara</i> | |
| Experimental Analysis of the Effect of Active Morphing of a VR-12 Airfoil for Unsteady Aerodynamics Optimization | 4863 |
| <i>William Refling, Thomas Sprengeler, Joshua Yurek, Charles Fabjanic, Yildirim B. Suzen, Jordi Estevadeordal</i> | |

PROPELLER/ROTORCRAFT/WIND TURBINE AERODYNAMICS IV

| | |
|--|------|
| Aerodynamic Design of Propellers for an EVTOL Aircraft | 4884 |
| <i>Carlotta Manca, Prasanth K. Murari, Kavipiriyam Shanmuganathan, Sachin Ramesh</i> | |
| Time Varying Rotor Aerodynamics for Quadrotor Vehicles | 4895 |
| <i>Christopher Smith, Alok Sinha</i> | |
| Design of Propellers with Passive Mitigation of Coherent Tip Vortex Roll-Up | 4913 |
| <i>Tove E. Kopperstad, Akhileshwar Borra, Andrew Beusse, Cecilia Kim, Elizabeth Torres De Jesus, Theresa Saxton-Fox, Phillip J. Ansell</i> | |

SPECIAL SESSION: UNIVERSITY LEADERSHIP INITIATIVE FOR ULTRA-EFFICIENT AIRCRAFT II

| | |
|--|------|
| Transonic Wind-Tunnel Testing of a Slotted, Natural-Laminar-Flow Wing at Full-Scale Conditions | 4932 |
| <i>James G. Coder</i> | |

Measurements of Crossflow Vortices and Tollmien-Schlichting Waves on a Slotted, Natural-Laminar-Flow Airfoil 4949
Jeppesen G. Feliciano, Edward B. White

Effect of Transition Modeling for Analysis of a Slotted, Natural-Laminar-Flow Transonic Truss-Braced Wing Aircraft Configuration 4968
Cody L. Perkins, Zhi Yang, Dimitri J. Mavriplis, James G. Coder, Lawton Shoemaker, Christopher J. Axten

Author Index